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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN No. 20.

B. T. GALLOWAY, Chief of Bureau.

MANUFACTURE

OF

SEMOLINA AND MACARONI.

BY

ROBERT P. SKINNER,
CONSUL GENERAL AT MARSEILLE.

VEGETABLE PATHOLOGICAL AND PHYSIOLOGICAL INVESTIGATIONS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., February 8, 1902.

Sir: I have the honor to transmit herewith a paper on the manufacture of semolina and macaroni, and respectfully recommend that it be published as Bulletin No. 20 of the Bureau series. The report was prepared by Hon. Robert P. Skinner, Consul General at Marseille, France, and was submitted by the Pathologist and Physiologist.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

MAR 31 1903
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PREFACE.

For several years past investigations of macaroni wheats have been carried on under the auspices of this Office for the purpose of promoting the wheat industry in this country, the work being in charge of the cerealist, Mr. Mark Alfred Carleton. A large amount of seed of the best quality has been imported from Russia, Algeria, and Argentina, and many of the varieties have been found to be admirably adapted for cultivation in our Great Plains region. Farmers have become much interested in the subject and the acreage planted to macaroni wheats is increasing each year with remarkable rapidity. As the use of the true durum wheats for macaroni is entirely new in this country, there is a great desire on the part of millers and macaroni manufacturers to understand more concerning the process of grinding these wheats into semolina and of making from this the various forms of macaroni.

The largest semolina factories are in France and Italy, where the greatest amount of good macaroni is produced. We are indebted to our consuls, Mr. Robert P. Skinner, Marseille, France, author of this report, and Mr. John C. Covert, Lyon, France, for much valuable information on the subject, and considerable of this has been published in Bulletin No. 3 of the Bureau—Macaroni Wheats.

The present report is of interest to the farmers in regions where the macaroni wheats can be grown, and of special interest to the millers and manufacturers in this country, and Mr. Skinner suggests that more attention be given to the export of semolina, as well as macaroni wheat.

ALBERT F. WOODS,
Pathologist and Physiologist.

OFFICE OF THE PATHOLOGIST AND PHYSIOLOGIST.
Washington, D. C., February 7, 1902.

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MANUFACTURE OF SEMOLINA AND MACARONI.

INTRODUCTION.

A NEGLECTED OPPORTUNITY.

The Secretary of Agriculture has observed that an increase of 1 bushel per acre in the average yield of American wheat would add enormously to the wealth of our country. He might have added, with equal truth, that the advantage of this increased production would be minimized unless remunerative markets could be found for the increasing surplus, and as it is the peculiar field of the Department of Agriculture to increase crops, so it is the especial duty of the consular service to seek for new markets. There is a market in Marseille that has grown from nothing within the last thirty years and is increasing by leaps and bounds, not only in this city, but throughout all Europe, its present daily requirements being 24,000 bushels of wheat. The ebb and flow of this market within recent years has been controlled by crops and not by the consuming public. The cry of this trade is for raw material, and, according to the last available expression of the Marseille Chamber of Commerce, the manufacturers of this city, deprived of a sufficient quantity of hard wheats from Russia, have been obliged to employ the "metadiné" wheats of interior France, which, owing to their inferiority, "have affected the quality of the edible pastes, the consumption of which has therefore been diminished." The raw material for this industry consists of hard or durum wheat, which is ground into semolina and then manufactured into macaroni, the latter word being here used as a generic term. The business has developed in the colonies of Algeria and Tunis a great wheat-growing industry. After satisfying domestic demands, the manufacturers of Marseille have exported a surplus amounting, in 1900, to 81,403,266 pounds of semolina and 10,811,356 pounds of manufactured macaroni.

Although one of the greatest wheat-growing nations of the world, France is prevented, because of its soil and climate, from producing the grain essential to the life of this industry; and the United States, the greatest of all wheat-growing countries, has yet to send its first pound to this port for the purpose above described. My present

object is, therefore, to urge upon our wheat-growing farmers the further specialization of their business, first, as a means of engaging in this Mediterranean trade, and, second, in order that we may build up in the United States a demand for the food products which we can have in all their excellence only after we have produced a sufficient supply of the durum wheat needed.

To the lay reader I may say that the so-called "hard wheat" of the United States is not at all the hard wheat of Europe, and the semolina now being manufactured in a small way in the United States from our native wheats, while a worthy product, is not acceptable in this market as a competitor with the semolina of first quality of local manufacture. Yet there is great encouragement to further effort and closer study on the part of our manufacturers in the success already attained: for, if the American product of the present is unavailable in France, the doors already swing inward for it elsewhere. In proof of this I have been shown by a Marseille exporter a letter written from Russia, in which it is stated that the Russian manufacturers "can not to-day pay the price demanded [for semolina] in Marseille, because the American granulated flours are offered cheaper; that is to say, $4.25 per 100 kilos (220 pounds), or 50 cents less than French quotations."

It is insufficient, however, to have made merely a good beginning. Every student of the situation, every importer of wheat, recognizes that we are lacking in the prime essential to complete success, that is, a wheat ranking with the macaroni wheats of Sicily, Russia, and Algeria.

DEVELOPMENT OF THE INDUSTRY IN FRANCE.

If the average person should be asked whence macaroni comes, he would answer immediately "from Italy." At one time this was true, and it arose from the fact that the native wheat of Sicily and that southern portion of Italy known as La Pouille possessed all the attributes deemed desirable in the typical macaroni grain. The industry had its birth in Naples, and the reputation of the Neapolitan manufacturers rests to-day mainly upon the fact that they had this wheat with which to work. In the course of years the Italians have neglected the cultivation of the grain, many wheat fields having been planted over with vines, so that now, commercially speaking, the hard wheat of Sicily and La Pouille is unimportant; nevertheless, its quality is as highly appreciated to-day as ever, and modern farming in Algeria owes much to the lessons learned from Sicily. With the growth in their business and the decrease in their supply of home-grown grain, the Italian manufacturers looked elsewhere for their supply of raw material, and they turned naturally to Marseille, a city where capital and business enterprise abounded. The Marseillais, always great manufacturers and exporters of flour, rapidly grasped the situation.

began to import durum wheat from Russia and Algeria, ground it into coarse flour—which we call "granulated flour" or "semolina," or in French "semoule"—and sold it to the Italians. The exports of this product from Marseille to Italy last year amounted to 3,510,111 pounds.

It was but a step from this starting point to the manufacture of the macaroni itself; and one improvement following another, and, the public demand for macaroni and other edible pastes rapidly increasing, they established large factories alongside their mills, and exportation began to all parts of the world, even to Italy itself. With the introduction of the Budapest roller process of grinding flour, the business expanded upon modern lines; and, whereas years ago every Italian family made its own macaroni and hung it out on the racks to dry, the manufacture has now become an industry of first-rate importance, requiring capital and enterprise.

As this is an elementary discussion of the matter, I venture to observe that our own homely dish of "noodles" could be traced back to the Italian macaroni. The difference between the two is that the macaroni is manufactured from coarse hard-wheat flour, or semolina, in making which the manufacturer attempts to remove the outer husk and break up the grains so as to secure granules rounded and glazed, instead of the impalpable powder of which ordinary flour consists. Macaroni (which I shall frequently use as a generic term covering all the manufactured products of semolina) is, strictly speaking, applicable only to the long, hollow tubes of dry food paste. This paste consists merely of semolina and water kneaded together; and it is converted into hundreds of forms, sometimes inelegantly referred to in English as "edible pastes," or in French as "pâtes alimentaires."

FRENCH METADINÉ WHEATS.

Until something like ten years ago, when the present French tariff upon wheat was imposed, all of the French macaroni was manufactured from semolina made from hard durum wheat. At that time considerable quantities of mixed wheat, or metadiné, were grown in France, but were manufactured into common flour, and were highly regarded. During the last ten years a steady increase has been noted in the amount of this wheat grown in France from durum seed, and more and more of it has been used for the manufacture of macaroni pastes. It is recognized that the semolina manufactured from these wheats is inferior to the standard Marseille type of semolina, but the difference in price on account of the tariff makes it advantageous to use the domestic wheat. The extension of the manufacturing business has slowly progressed from the city of Marseille to a very considerable portion of France, in which these mixed wheats are grown. The Marseille manufacturers have been slow to recognize that the growth of this branch of the semolina business has been such as to constitute

it a very respectable competitive force. The macaroni manufacturer never uses the metadiné semolina without an admixture of more or less durum wheat semolina, and the product, which is much cheaper in the market, is consumed almost entirely in France. The product of this mixed semolina is never macaroni, properly speaking, which can only be manufactured successfully from a strictly hard wheat, but the metadiné semolina makes a satisfactory macaroni paste, sold in the form of vermicelli, escargots, stars, and other arbitrary shapes used for soups and various dishes very popular in France.

The metadiné wheat of France, peculiar to the Department of Gard and that of Vaucluse, is a half-hard wheat, resulting from the sowing of a genuine durum which deteriorates. The wheat produced can not be planted for a second crop. The durum requires less care than soft wheat in the regions where it is grown, and the yield is larger. This wheat also resists climatic changes much more readily than the native French wheat, and can better stand a dry season.

GROWTH OF THE DEMAND FOR MACARONI.

More interesting than the development of the manufacture of semolina is the history of the increase in the consumption of the edible product.

The broad lines of this development have been thus described by Mr. François Scaramelli, one of the most important manufacturers of edible pastes in the world, and an exporter of large quantities to the United States (Plate I, fig. 1). Mr. Scaramelli says:

> The manufacture of macaroni pastes has doubled in Marseille within ten years, and the domestic consumption of the product has also increased and continues to increase enormously. In 1866, when I first traveled about the country selling the output of our then small factory, I once reached the village of the Grande Combe, where I found that the only dealer in macaroni was the local druggist, who said that he bought 25 pounds per annum, which was sold exclusively for consumption by invalids. At the present time, the same village takes 25,000 pounds of macaroni per month, which is sold practically to every family in the place. It has become a staple article of diet, replacing to a large extent the peasant soups, formerly made of bread and vegetables. In the city of Marseille, the consumption has tripled in twenty-five years. In 1872 there were ten macaroni factories in Marseille, producing 220 pounds per day each. There are now 55 local factories, turning out a total of about 85,000 pounds per day. The industry requires the labor of from 400 to 500 men, and from 500 to 600 women, according to the season. With two or three exceptions, these macaroni factories are very small affairs, catering to a local demand, but the aggregate of their business is large. I naturally look for the gradual extinguishment of these smaller concerns, and the absorption of their businesses by the larger. When the consumption of edible pastes began to move forward with giant strides the manufacture of the article seemed to promise large returns to persons of limited means, but the improvements in the mechanical processes and the necessity for heavy investment in order to keep abreast of the times is bound to force weak competition from the field. I am speaking of the manufacture of macaroni exclusively. There are 127 mills for grinding grain in Marseille, of which 50 make more or less semolina,

FIG. 1.—MACARONI FACTORY OF F. SCARAMELLI FILS AT MARSEILLE.

FIG. 2.—FLOUR AND SEMOLINA MILL OF ALLATINI & CO. AT SALONICA.

and 20 are devoted exclusively to this trade. It will thus be seen that the industry is a very important one from every point of view.

The extension of this business in Marseille is in less degree observable throughout the Mediterranean country. Semolina mills have been erected or are in course of construction in all the important wheat markets, and in the Levant, where the manufacture of this article dates from very recent years, the increase is especially noteworthy. Perhaps the largest semolina mill in the world (Plate I, fig. 2) is that owned by the great Italian firm of Allatini & Co., recently completed at Salonica, and having a consumption of 2,000 quintals (1 quintal = 220.46 pounds) daily of hard wheat. The reason for this rapid extension of the business is that macaroni in its numerous forms is a palatable, nutritious article which satisfies the desire for food at a very moderate cost, largely replacing meat dishes, which are steadily becoming more expensive throughout the world. There is no pretense that macaroni is a "health food" or a "breakfast dish," or that it contains a high percentage of nutrients or heat units. It is simply a food which appeases hunger and satisfies a healthy appetite. The excellence of this food is not generally known throughout the United States. The value of the declared exports of macaroni from Marseille to the United States for the fiscal year ended June 30, 1901, was only $44,504; and, while this was but a fraction of the total amount imported, it is reasonable to suppose that the grand total was not large.[a]

With the exception of a few especially well-served markets, the average macaroni sold in the United States has passed its prime before it reaches the consumer. Most of us have seen a few brittle lengths of stale vermicelli or still staler macaroni exposed for sale in glass jars, like old-fashioned stick candy, in the country grocery store. Few of our housewives have studied the possibilities of fresh macaroni as an article of diet. In Europe, on the other hand, it is sold when in its best state, and after passing through the hands of a competent cook can hold its own in a hundred different forms with any competing product which may be served, from soup to dessert.

NEED OF GROWING THE DURUM WHEAT.

The recipe for making a good dish of macaroni is like the famous rule for making a rabbit pie, "First catch your rabbit;" and the surprising fact in this connection is that, at this time, the United States has yet to grow the quality of wheat essential to the macaroni industry.[b] Before I saw the immense importance of the macaroni trade as

[a] The total import for the year ending June 30, 1901 was 18,186,399.83 pounds, valued at $735,239.49—M. A. Carleton.

[b] About one million bushels of the durum wheat will probably be produced in 1902—M. A. C.

a means of augmenting our exports of wheat, and being confident that in grain we could supply anything that the world might demand, I sent reports on the subject to the Department of State, written in 1899, advising exporters of the need of this market for a good hard wheat. To my astonishment it was promptly developed that we had no wheat of the quality required, and that the so-called hard wheat of the United States contained grains differing in degree of hardness, which speedily clogged the milling machinery, and was entirely unfitted for the purpose. The Department of Agriculture has since sent experts to Europe to study the question. I have no doubt that their researches will add much more to the stock of useful information than my present effort to describe the business as seen by a layman, and as it is conducted to-day.

THE MARKET FOR DURUM WHEAT.

WILD GOOSE WHEAT.

Before proceeding to a more technical account of this matter, it may be useful to report the results of a number of interviews with Mr. G. P. Bottazzo. Mr. Bottazzo has created a very large business for himself in this city as a broker of semolina, and his views of the possibility of serious American competition are entitled to high respect. It is fair to mention that his opinion of the Canadian Goose wheat which he describes is not shared by all of the experts in this city.* Mr. Edmond Bendit, a very extensive importer of grain, to whom a a sample of the wheat in question was submitted, declared that, while appearing to be of excellent quality, and of a hardness sufficient for the semolina trade, it could not be claimed for it that it equaled the best Russian wheat. Substantially the same opinion was given to me by the firm of Allatini & Co. These are manufacturers of semolina at Salonica, and one of the most important houses in Marseille. Both Mr. Allatini and Mr. Fernandez of the same firm commended the appearance of the wheat and of the semolina it produced, but seemed to think that it was deficient in gluten, and could not be relied upon to produce a satisfactory macaroni without the admixture of a stronger product. Mr. Bottazzo's less measured statement is as follows:

Since the 1st of May, 1901, we have received at Marseille about 100,000 tons of hard Goose wheat, shipped by New York firms, and supposed to have been grown in Manitoba. I am satisfied that it has been grown from Russian seed, and it is perhaps three or four crops removed from the original seed. In past years, other Goose wheat has been offered for sale, but the quality until this year has never been such as to enable us to use it for the manufacture of semolina. This Goose wheat of which I speak is as good as any macaroni wheat ever sold in this market. It is all being consumed in the semolina mills at Marseille, to the entire satisfaction of the pur-

*It should be observed that Canadian Goose wheat is already known to be inferior to that grown in North and South Dakota.—M. A. C.

chasers. It sells at from 3 to 5 cents less than superior Taganrog, and it ought to command as high a price, but being less well known it has that disadvantage to overcome. It contains from 12 to 14 per cent of dry gluten.

PROSPECTIVE DEMAND FOR AMERICAN HARD WHEAT AND SEMOLINA.

Continuing in response to queries, Mr. Bottazzo said:

I am not interested in the development of American commerce, but I consider that the laws of trade are higher than those of governments; that business should be developed under circumstances most favorably adapted for such development, and that the transfer of an industry from one point to another is generally compensated for by some advantage accruing to the locality thus temporarily affected. It is for this reason that I believe America to be capable not only of supplying the hard wheat requisite for the macaroni trade, but the semolina as well. I call your special attention to the fact that, up to this time, you have only concerned yourself with the production of a hard wheat for our market. I ask that you go a step further, and convert that wheat into semolina. You tell me that semolina is a perishable product, but I answer you out of my experience that this is largely a matter of assumption. If semolina is thoroughly well made in the first instance, there is no question that it will stand transportation, and retain all of its good qualities for any reasonable length of time. I have personally known semolina properly manufactured that was found to be in a perfect state after eighteen months. Our difficulty in Marseille is this: We receive wheats from all parts of the world, varying in degree of hardness, differing in the size of the kernels, and in their component parts. The mills themselves are comparatively small. Considerable quantities of semolina are manufactured to order for commission houses. Thus the manufacturer is obliged to change his process to suit rapidly varying conditions, and is never enabled to keep his machinery geared to any average standard of wheat, and for that matter never acquires an absolute knowledge of any one wheat, such as your millers in the United States are able to acquire. You will have no difficulty, if you pay proper attention to the matter, in growing macaroni wheat in the United States in unlimited quantities, and, having done that, your manufacturers will have no excuse for not operating their mills year in and year out with the same kind of wheat, thus permitting them to study and correct every defect and place upon the market a semolina equal to the best of which we now know.

It is believed that a market could be built up in Europe for from 10,000 to 15,000 bushels of semolina a day. Let your manufacturers describe to me their system, tell me whether they wash or do not wash their wheat, the time they devote to the scouring process, the exact interval of time between the scouring process and the beginning of the grinding; let them describe their means of purification of the semolina after grinding, and if they will send to me every detail, I will return to them all the supplementary information they require to achieve a satisfactory result. Let them send samples of their actual production. The semolina now manufactured in the United States and of which I have seen samples, although produced from comparatively soft wheat, is yet a marketable product. I am satisfied that firms now in this business in a tentative way could very readily equip themselves for the production of a superior grade of semolina. The first thing for us to have in Marseille is samples.

EUROPEAN METHODS AND PRODUCTS.

Speaking of the European macaroni wheats and semolina, and the methods employed in the manufacture of the latter, Mr. Bottazzo said:

When different qualities of wheat are mixed before the grinding process begins, the product is inferior. The miller has need of but one particular quality of wheat

to produce semolina. After the semolina is manufactured, a mixture is sometimes effected, in order to secure a certain standard. No hard wheat has less gluten than the wheat of Salonica, and the wheat of Salonica has always stood at the head, because it is always handsome when purified. One of the principal manufacturers of edible pastes in Marseille purchases semolina from each of the fifteen millers and the semolina of the same size is mixed together indifferently for the manufacture of the product. Of course, when a particularly fine macaroni is required for a special purpose, there is a special effort made to procure semolina corresponding to the high grade of macaroni required. The great point concerning semolina is its purity.

The territory northwest and northeast of the Azov furnishes the hard wheat most appreciated at present, and containing the greatest quantity of gluten. After Russia, and in order of importance as countries growing hard grain, come Algeria and Tunis, India, and Chile. The Chilean wheat has a rubbery quality, and is neither regular nor hard.

It is possible to arrange a mill for the manufacture of either semolina or flour by the change of cylinders, but the product is necessarily inferior. To produce semolina of the first quality the mill should be constructed exclusively for that purpose. Here it is necessary to wash the wheat, for the simple reason that it is very dirty, and contains much earth and other impurities. But in America a thorough dry cleaning would suffice, and it will be necessary to follow this plan in order that the product may be preserved. It is perfectly possible to dry-clean the wheat, and brush it, by employing what we call "désagrégeurs." After passing through this machine, if the process is well carried out, the wheat is absolutely pure, and the semolina resulting from the manufacture of wheat thus cleaned may be preserved for a long time. The semolina manufactured at Marseilles is never dried after manufacture, for the great reason that it is consumed in this market promptly, and the process is unnecessary. The production of semolina involves the production also of a certain percentage of an inferior flour.

Semolina has been manufactured here for sixty or eighty years. The business has been materially extended within the last twenty-five years. Marseille is the center of the industry. The extension dates more particularly from the introduction of the purifiers in mills. At present the industry is extending rapidly throughout Italy; in France, in the cities of Valence, Lyon, Montelimar, and Toulouse; in Germany at Mannheim and Konigsberg; in Russia, in Greece, and in Tunis and Algiers. We receive at Marseille annually 100,000 barrels of two hundredweight of semolina from Constantine, Algeria. At Salonica 1,000 sacks are made per day, and sold very generally. At Smyrna also there are mills, which, however, are very bad, and the semolina is used for the manufacture of "pates alimentaires," although a certain quantity is also used in the manufacture of various kinds of bread.

SCOURING THE GRAIN.

Before leaving Mr. Bottazzo's statement, it should be added that his contention in favor of eliminating the washing process in American semolina mills opens a field of controversy which only actual experience can settle. While Mr. Bottazzo assumes the washing process to be necessary in Marseille because of the foreign matter generally found in Old World wheat, and while I have found other practical men who charge that the scouring process is to some extent adopted in order to give the product additional weight, I have equally strong expert opinion to the effect that the moistening of the grain enables the removal of the bran in less broken particles, while dry grinding causes it to

crack and enter into the semolina itself, from which it can not be entirely removed. Mr. Bottazzo's statement was shown to Mr. Jean Baptiste Lautier, a practical miller, who said:

Mr. Bottazzo is not entirely correct in his assumption that satisfactory results can be obtained in the manufacture of semolina without the scouring of the grain. Our experience in Marseille is that the moistening of the grain causes the bran to flake off in large particles during the milling process, enabling us to secure not only a first-class quality of semolina, but also a merchantable quality of flour. When the wheat is dry-cleaned the bran, being more brittle, enters into the various products the more readily, and while the semolina thus produced is of good quality, the flour is of inferior quality and very unattractive in appearance. The proportion of fine semolina obtained by the dry-milling process is about the same; but the relative proportion of large semolina, which is the most desired, is from 3 per cent to 4 per cent less. The practice of scouring the wheat is subject to no exceptions in Marseille, and the matter of moistening it is so important, especially in its effect upon the appearance of the semolina, that if the scouring process is insufficient in any respect the manufacturer is sure to bring reproach upon himself. Absolutely the only dry-milling undertaken in Marseille is for the account of Jewish clients, who require the flour for the production of their unleavened bread once a year. If the only question confronting the manufacturer was to preserve his product for a considerable length of time, doubtless an attempt to avoid the washing of the grain would be advisable.

I might suggest one method of securing the advantages of both wet and dry cleaning sometimes followed in this city. If instead of permitting the wheat to repose for from 10 to 40 hours, as is usually the case, after passing through the water, it should be carried immediately to the machinery, the outer husk only being dampened would be removable in large flakes, and the speed with which the operation would be carried out would at the same time prevent the humidity from penetrating the kernel. I should be inclined to recommend this system in the United States, where the preservation of the semolina for a number of months would be important. In this manner the bran would be prevented from entering into the flour and semolina, and, while the flour itself might be perhaps a little less attractive in appearance, the net difference to the miller would be small.

MANUFACTURE OF SEMOLINA.

USING WHEAT FROM DIFFERENT COUNTRIES.

The statistics relating to the importation of wheat at Marseille appear elsewhere. There are 20 mills requiring from 7,000 to 8,000 quintals (1 quintal = 220.46 pounds) of raw material per day. There are also 10 mills which grind alternately the hard wheat for the macaroni trade and soft wheat flour for general purposes, according to the market. Mills of this class require about 3,000 quintals per day. There are 60 mills in this city grinding soft wheat into flour to the extent of from 12,000 to 15,000 quintals per day. The most important flour mill in this city requires 800 quintals per day of wheat, and the average requirement is from 200 to 300. In addition to the mills mentioned there are 5 other mills which grind beans into flour, requiring an aggregate of 1,000 quintals per day.

The durum wheats of Algeria, although containing less gluten than

the semolina wheats of Russia, constitute a standard type for the manufacture of semolina, as the product is shiny and clear. As these hard wheats are very often insufficient in quantity for local purposes, and furthermore lack the necessary proportion of gluten, the resultant product of the wheat is very frequently mixed by the millers according to their special interests and the market prices. Ordinarily Algerian or Tunisian wheat is mixed with Russian or Turkish wheat, and sometimes with Indian. One authority was asked to supply formulæ for the composition of a theoretically perfect semolina, but he replied that, while millers and others might be disposed to discuss chemical composition in pedantic fashion, in practice there was very little attempt to realize elaborately spun theories. Millers and macaroni manufacturers by long experience were familiar with the appearance of semolina that would yield a certain quality of macaroni, and when they went into the market they smoothed down a sample on a sheet of paper, held it up to the light, looked horizontally across it, and if it was bright and clear, they bought. Wheats are always ground separately. Sometimes the manufacturer mixes the semolina himself, and sometimes the manufacturer of the macaroni does this.

CLEANING THE WHEAT.

The manufacture of the semolina begins with the cleaning of the wheat, including washing by water. The Russian wheats contain more moisture than the Algerian, and should be dampened more lightly, and allowed to repose during a shorter period between the scouring and the beginning of the grinding. The length of the repose after the scouring is a very delicate question for the Marseille miller to determine, as the moisture must penetrate to the heart of the grain in order that the bran and the cells of the wheat may be less broken up into flour, which of course the semolina manufacturer wishes to avoid. In the old days of grinding with millstones the wheat was not allowed to rest between the scouring and the grinding, but it was found by this means that the outer husk absorbed all the moisture and the by-products of the manufacture of semolina could not be secured. Since the application of the roller process in 1881 a uniform system of procedure has been followed in all of the French semolina mills, and distinct progress has been made in the intrinsic value of the product and in the amount of semolina per quintal of grain. This washing process is so important that I give a description of a typical French scouring system written by M. Charles Dantin.

In the manufacture of semolina in France, the wheat is first scoured with water, then dried, and then a second time moistened. It reposes, as previously explained, after the second application of moisture, for ten to forty hours before going to the cylinders. The first scouring

I venture to describe in some detail, using for the purpose the words of Mr. Dantin:

An excess of humidity in the wheat exercises a dangerous effect upon the flour, involving the alteration of the gluten, development of organisms, disagreeable odor, and gray color. The maximum proportion of water should be 18 per cent, as milling becomes very difficult after the proportion reaches 20 per cent, the cylinders becoming clogged. As hard wheats are uniformly drier by nature, the washing process is easier than in the case of soft wheat. The washing operation leaves from 1 to 5 per cent of water incorporated in the wheat, the cause of this variation depending mainly upon the quality of the wheat. It is desirable of course that the grain conserve a certain degree of humidity, which benefits more or less a subsequent dampening, and facilitates decortication.

The advantages of the application of moisture, either in connection with the scouring process about to be described or as a succeeding operation, are thus set forth by Messrs. Millon & Mourin, of Algiers:

The water, spreading readily upon the surface of the kernels, does not immediately penetrate into the interior. Wherever the surface is dampened, the adherence of the external pellicle is destroyed; the external tegument of the grain separated by decortication then forms bran of a remarkable lightness. Above all, the milling of decorticated wheat proceeds with regularity unknown in the case of the dry-cleaned wheat.

Water is therefore considered not only the most useful agent for cleaning wheat, even of such impurities as may lodge in the crevices of the kernels, but as one which facilitates the decortication itself. These are the considerations which have brought about the general adoption of some scouring device in France. The description below covers the essential points of the Savit & Boutet system for the purifying operation:

In the basin of the device the water is taken at a temperature varying with the season. Now, when upon still water one drops with care a grain of wheat with dry fingers, the grain floats a long time. If a pebble of the same size as the grain of wheat is dropped similarly, it may float also, but for a very short time, since the wheat has a density but little higher than that of water, and the pebble a density much higher. Upon this principle the Savit & Boutet machine is constructed. If, in place of depositing a grain with the fingers, it is dropped upon a curved surface with which the surface of the water forms a tangent, the wheat will still float. As to the pebbles, as they float but a short time, if the whole be permitted to continue in movement, the wheat will float to the end, while the pebbles will sink quickly. Thus we may extract bodies of greater density than wheat without immersing the latter. The apparatus (fig. 1) is composed of a flat receptacle *P*, which turns upon an axis forming a basin covered with water regulated from *O*. This basin possesses a flange around the edge, tending to prevent foreign bodies very slightly more dense than wheat from being swept along with it. The tube *T* receives the

grain, which may be cut off by shutter at *V*. This tube feeds the wheat upon cone *E*, the inclination of which is such that the grain may fall upon the water with nicely adjusted speed, the grain being distributed upon the cone by the distributor (babillard) *B*, which is fixed on the vertical tree *A*. The basin *P* turns within and above a circular canal *C*, composed of two portions, one receiving the wheat and completely surrounding the basin; the other, *C''*, embracing the arc

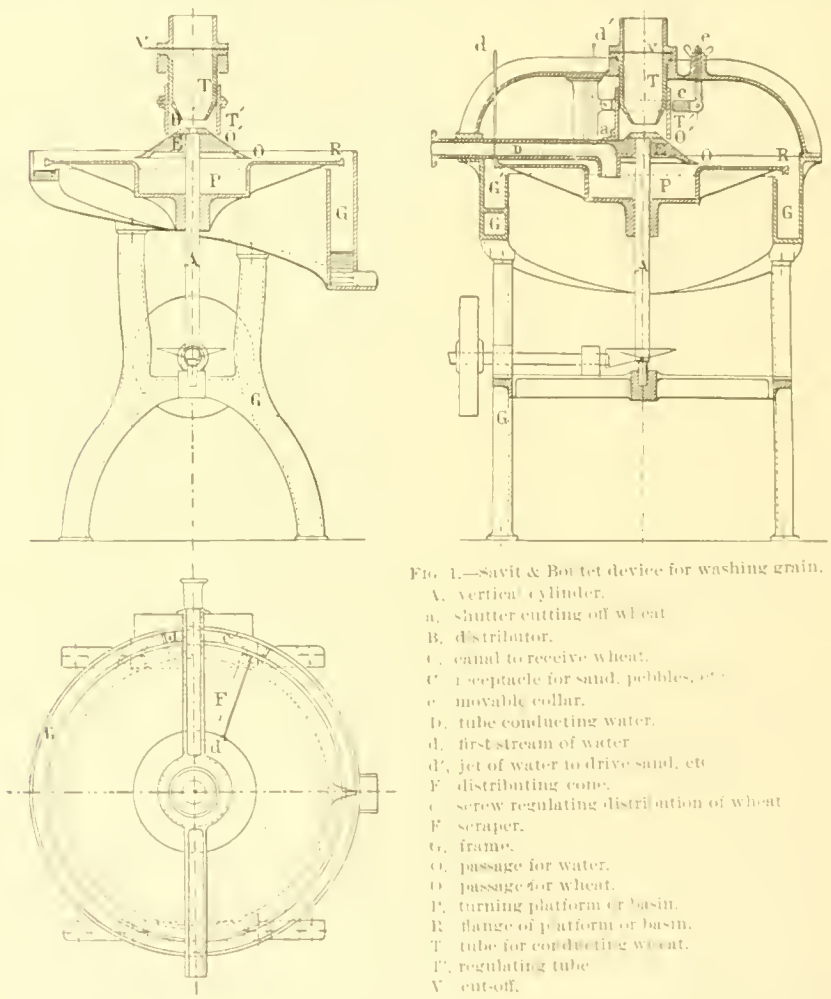


FIG. 1.—Savit & Boutet device for washing grain.
A, vertical cylinder.
a, shutter cutting off wheat.
B, distributor.
C, canal to receive wheat.
C', receptacle for sand, pebbles, etc.
c, movable collar.
D, tube conducting water.
d, first stream of water.
d', jet of water to drive sand, etc.
F, distributing cone.
c, screw regulating distribution of wheat.
F, scraper.
G, frame.
O, passage for water.
O, passage for wheat.
P, turning platform or basin.
R, flange of platform or basin.
T, tube for conducting wheat.
T', regulating tube.
V, cut-off.

between the two jets of water *d'* and *d''* and receiving the particles of sand, etc. A cast-iron frame, *G*, supports the whole.

The water arriving by the tube *D* fills the basin, and playing with more or less pressure from the circular orifice *O* spreads over the shallow basin and drains over the flange *R*. The depth of the water passing over the flange should be sufficient to allow the passage of a grain of wheat. The wheat distributed from the orifice *O* drops first

upon the cone *E*, then to the water, whence it floats, and is swept over *R* and falls into the canal *C*, the inclination of which is such that the grain goes quickly to the drying column, where it is immediately dried. The distance across the surface of the basin is such that pebbles and other foreign particles have sufficient time to sink.

As the basin rotates continually, the foreign matter remaining is brought under the jet of water *d'* which is so regulated that any heavy

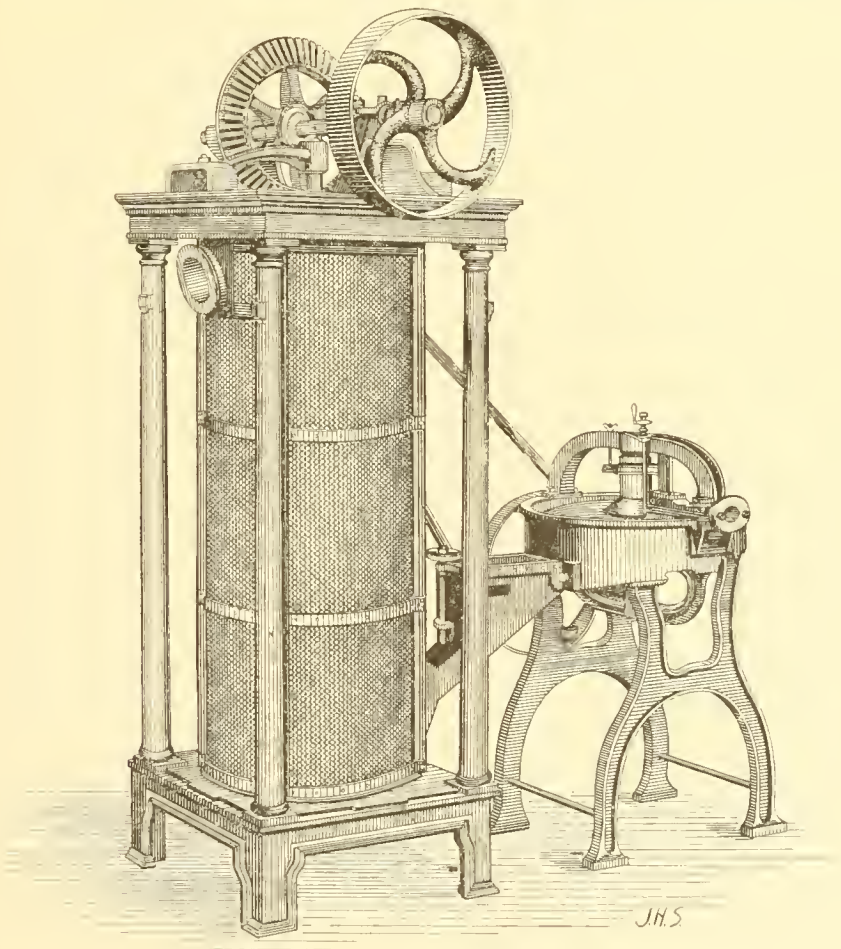


FIG. 2.—Drying column, with scouring device for washing grain.

grains of wheat remaining, and which might otherwise remain with the stones, are swept over the flange also between two jets of water; there remain then only bodies of greater density than wheat, which are forced below the flange *R* and thence fall into the canal *C''* and are cared for in a special receptacle. Thus it will be seen that the operation is performed without the immersion of the wheat, since the latter floats and is not much dampened. The operation of dampening

begins after the wheat falls into the canal, and lasts until it enters the drying column. This operation continues about three seconds. The drying column designed originally by Pierre Cardillhac is shown in fig. 2, and consists of a perforated cylinder through which the grain passes rapidly, and is frequently so dry that it must be redampened before the milling begins. The entire device is capable of treating 30 hectoliters (67 bushels) per hour.

PERCENTAGE OF SEMOLINA IN DIFFERENT WHEATS.

The manufacturers of the best quality of semolina, known as "S. S. S.," expect the resultant product to be 60 to 65 per cent semolina, from 12 to 15 per cent flour, and from 18 to 20 per cent bran. This proportion is quite different when the native metadiné, or mixed wheats, are employed, in which event a smaller proportion of semolina is expected, varying from 30 to 40 per cent, inferior in quality and containing impurities which reduce its value. The proportionate amount of flour is greater with these wheats, and the quality of the flour is better than that resulting from the grinding of the strictly macaroni wheats. The grinding of the pure macaroni wheat into flour is very rarely attempted, although in Algeria a good deal of flour is thus made, and the bread is of good flavor and very nourishing. The manufacture of flour from macaroni wheat, in addition to other disadvantages, requires the expenditure of additional mechanical force.

IMPORTANCE OF CLEANLINESS.

The average hard wheat is said to contain from 8 to 12 per cent of moisture, which is considerably increased by the washing, as the process is now followed in Marseille. It naturally follows that the semolina and flour of hard wheat retain their virtues for a length of time dependent upon the season in which they are manufactured. In winter they will retain their original qualities for five or six months, while in summer one or two months is perhaps the life of the product in merchantable condition, after which worms are very likely to be found in it, in which case the semolina must be resifted and rebolted. The increase of these worms is prevented to a large extent in the French mills by attention to cleanliness. In those mills which are cleaned twice a year, where whitewash is used with liberality, very few are ever seen, while in others, where less attention is paid to details such as these, the timbers are covered with them.

THE MILLING PROCESS.

The American miller will probably add little in France to his knowledge of merely mechanical processes. Few, if any, machines of French invention are employed in the French mills, the Budapest process having been adopted and adapted to the peculiar local necessities. American winnowing machines are in general use. Nevertheless, illustrations

with proper explanation are submitted of several of the devices essential to the production of semolina.

In the milling of the semolina wheat, the arrangement of the machin-

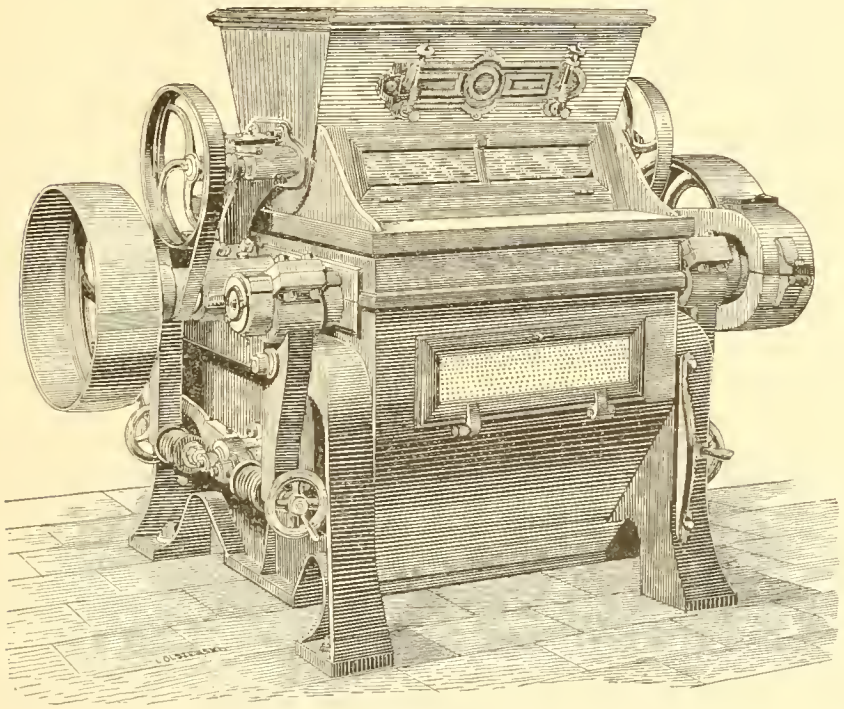


FIG. 3.—Typical French milling machine with four cylinders.

ery is not radically different from that required for the grinding of soft wheat into flour. (See figs. 3 and 4.) The scouring process is identical, but as the hard wheats used here contain a very much larger proportion

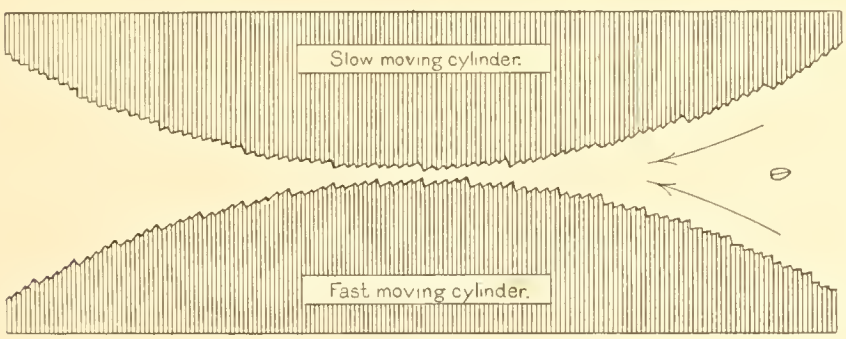


FIG. 4.—Cross section of rollers used in producing semolina.

of foreign matter than the soft wheats, the scouring is much more energetic, and is followed by a much more active winnowing process. The wheat, having been first dry-scoured in separators, winnowing machines,

and culling machines, goes to the washing machine, and after the washing is received in sacks or in bushel measures, where it reposes during the necessary time. After the period of repose (varying from ten to forty hours), it is beaten and blown and brushed, and is then ready for the first crushing.

The miller's object is to obtain the highest possible proportion of semolina, and the least possible proportion of flour. To do this, the cylinders work with no more pressure than is absolutely necessary in order that the moistened bran may detach itself from the wheat in large flakes and the grains of semolina be secured without being unnecessarily bruised. To facilitate this work there are ordinarily two crushing operations in addition to those to which soft wheat is subjected, during which the coarsest semolina, passing through No. 16 bolting cloth, is withdrawn. After the crushing all the products are classified

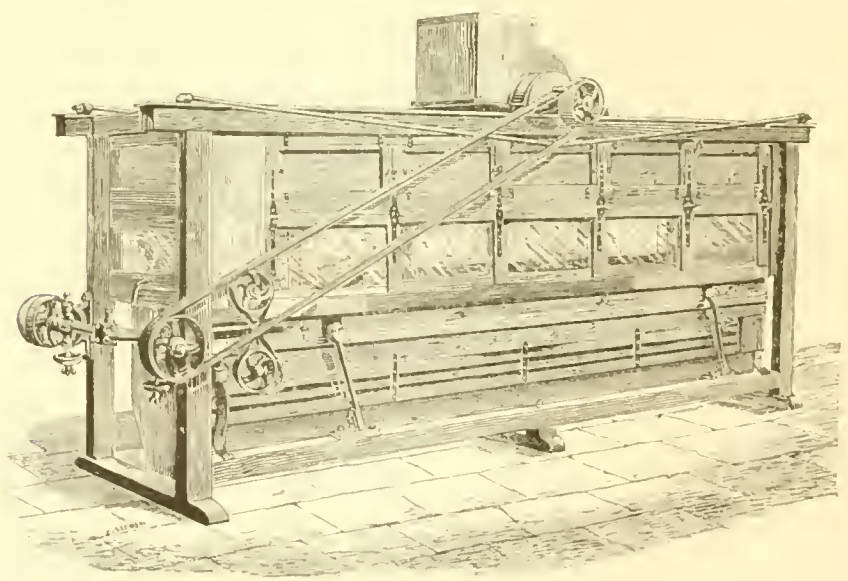
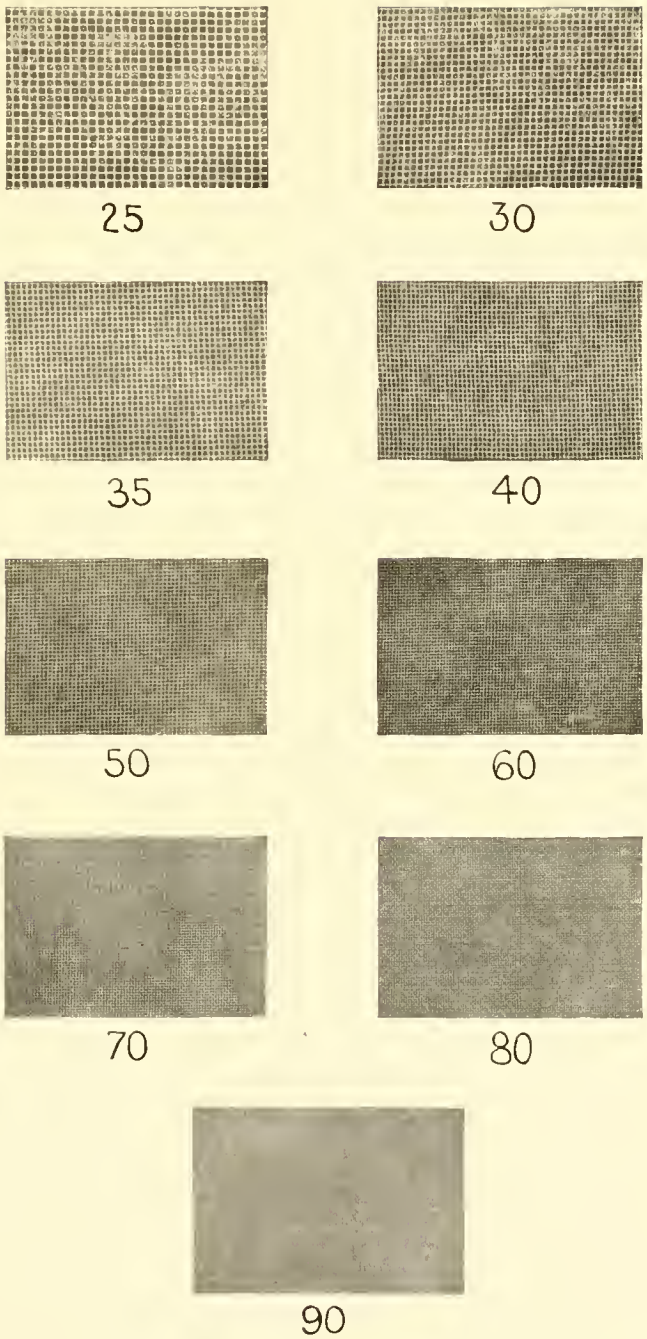


FIG. 5.—The sasseur.

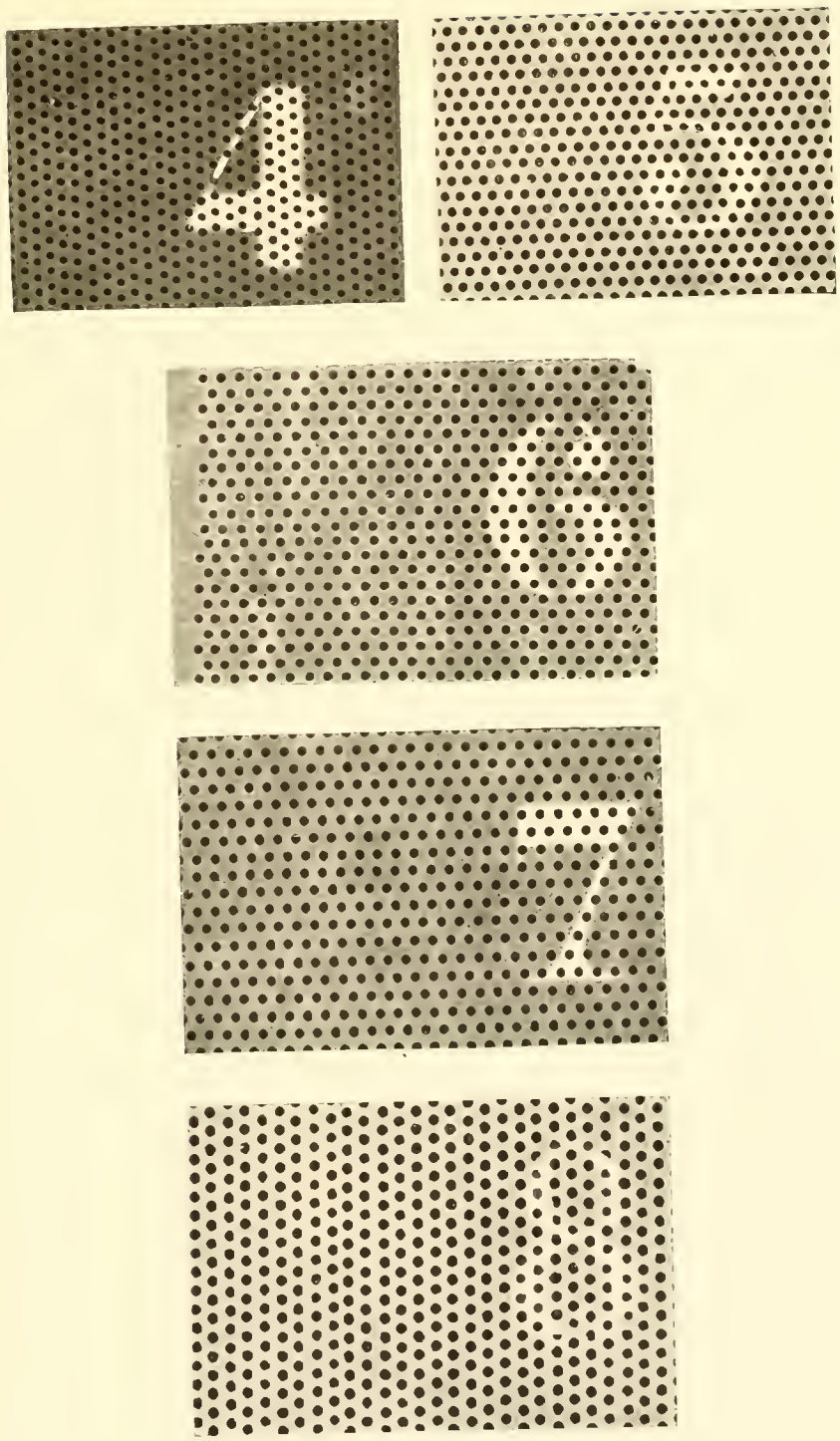
on "planchettes" according to their size, and are then transmitted to the bolters, which clean them. The most important operation is the final winnowing for the refinement of the semolina, and in order that this may be done under satisfactory conditions, it is essential that the semolina shall first be classified according to size, well dried, and relieved of fine particles. Each class of the semolina thus obtained is then sifted separately, upon ventilated sifters, the dust and foreign matter being blown away, and the clean semolina dropping through the sieves, from which it is delivered into sacks ready for the market.

CLASSIFICATION OF PRODUCTS.

The final operation in the production of semolina is performed in a machine known as a "sasseur" (fig. 5), the manner of operation (fig. 6) being as follows:



DIFFERENT GRADES OF BOLTING CLOTH FOR SEPARATING AND CLASSIFYING SEMOLINA.



SIEVES USED IN THE SASSEUR.

The unpurified and unclassified semolina is delivered upon the separator or sieve of waxed paper (fig. 6, A–A), upon which it is continually shaken while a current of air passes upward from below. The rounded, polished grains of semolina which are too large to pass through the sieve are carried forward in the direction shown by the arrows pointing toward the left, and is finally delivered into sacks. The smaller grains fall through the sieve, in the direction indicated by the arrows pointing downward, and are afterwards reclassified. The lighter portions (flour, etc.) are carried upward by the current of air, the heavier particles dropping backward onto the smaller sieves, B B, and the flour dust being expelled in the direction of the arrows pointing upward.

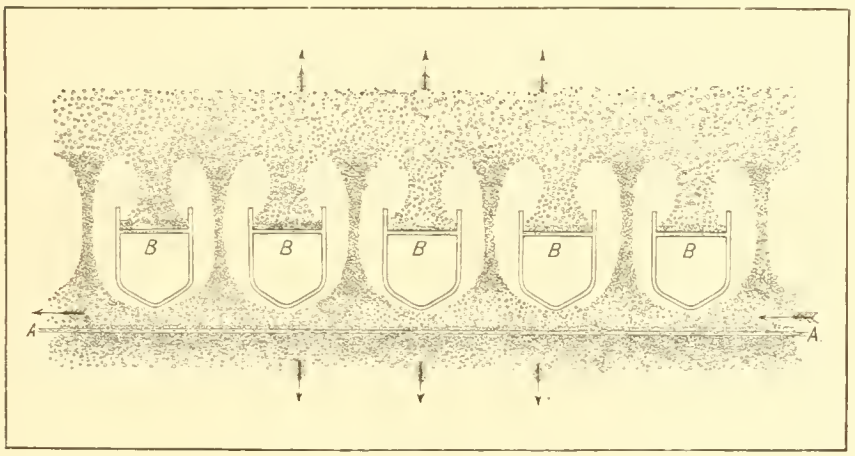


FIG. 6.—The sasseur in operation.

The French semolina is classified according to size, the trade terms being as follows:

Semolina sifted, passing through sieve—	
No. 20 to No. 25	"G. G."
No. 25 to No. 30	"M. G."
No. 30 to No. 40	"S. S. S. G."
No. 40 to No. 50	"S. S. F."
No. 50 to No. 60	"S. S. S. F."
No. 60 to No. 70	"S. F. S."
No. 70 to No. 80	"S. B."

All the products passing through numbers 80 to 90 French silk, are classed as flour. (See Plates II and III.)

Of the flours that are produced during the manufacture of semolina from 10 to 12 per cent are known as "Gruau hard," and from 3 to 5 per cent as "Minot hard." The hard Gruaus are produced from the operations of crushing and classification, and are of fair quality. Minot hards are of inferior quality. All the other flours and products of the grinding, except those already enumerated, are classified as brans, and receive the following designations: (1) Flour, "F. B. D.;" (2) "Repasse hard;" (3) Coarse hard bran.

Under average conditions 50,000 kilos of hard African wheat will yield the following products:

Classification.	Quantity	Percentage.
SEMOLINA.	*Kilos.*	*Per cent.*
S. S. S. G.	3,200	6.40
S. S. S.	15,180	30.36
S. S.	4,800	9.60
S. S. S. F.	6,670	13.34
.....	2,650	5.30
Total semolina.	32,500	65.00
FLOUR.		
Gruau hard	7,000	14.00
Milrot [illegible]	1,500	3.00
Total semolina and flour	41,000	82.00
REFUSE.		
F. F. D.	9,000	2.00
Repasse	3,000	6.00
Course bran	4,500	9.00
Waste in cleaning[a]	1,500	3.00
Total product	51,000	[b]102.00

[a] Consisting of small grains of wheat, barley, weed seeds, etc.
[b] Excess of 2 per cent accounted for by admixture of water.

The average price of semolina is from 30 to 33 francs per 100 kilos (85.79 to 86.36 per 220 pounds). As much as 40 francs ($7.72) and even 48 francs ($9.26) has been paid under exceptional market conditions, the lowest price recorded being 23 francs ($4.43) per 100 kilos. The wholesale price of macaroni, which contains practically no raw material other than semolina, averages from 48 to 50 francs ($9.26 to $9.65) per 220 pounds.

MANUFACTURE OF MACARONI.

While Marseille at the present time leads the world in the manufacture of semolina, this is not yet true of the edible pastes manufactured from semolina. There are in this city some 40 small manufacturers of macaroni, each averaging from 300 to 400 kilos per working day, and depending upon a local and restricted trade. There are 5 or 6 important concerns producing from 1,000 to 1,500 kilos each per day. The firm of Rivoire & Carret, for example, manufacture from 15,000 to 20,000 kilos per day, and have two factories in different parts of the city. Another house, that of F. Scaramelli Fils, which exports very heavily to the United States, turns out from 5,000 to 6,000 kilos per day. The firm of Rivoire & Carret have large factories also at Paris, Lyon, and Mulhouse in Switzerland. The total production of edible pastes in Marseille amounts to 45,000 kilos per day, and this is probably equaled by the production of Lyon. In Switzerland there are also very important concerns, and, as I said before, the business is steadily increasing everywhere.

THE PROCESS.

The generic term for edible pastes in France is "pâtes alimentaires." We are accustomed in the United States to speak of these articles as "macaroni," but in point of fact macaroni is merely one of a hundred different forms in which edible pastes are produced. The composition is much the same in all cases, the different designations referring to form and size. The method of manufacture is comparatively simple, as modern mechanical methods are simply enlargements of the old family process by which the housewife mixed flour and water, kneaded the batch, rolled it into sheets, cut it into strips, and hung it out to dry. In the modern factory the semolina is measured into a steel pan about 8 feet in diameter, within which travels a stone wheel. Water is added, the machine is put in motion, the wheel moves slowly around the pan, thus kneading the batch until it attains proper consistency. Just ahead of the wheel is set a small steel plow, to gather and turn over the mass so that it falls under the rim of the approaching wheel, thus guaranteeing an even kneading of the whole amount of semolina measured out. From the kneading machine the dough passes to steel presses (Plate IV, fig. 1), by which it is converted into marketable form. From the presses the product goes to the drying rooms, where it is seasoned, after which it is packed and placed on the market.

All of the foregoing is apparently easy and few pitfalls are observable. Nevertheless, before the batch is prepared for the petrin or kneading machine, a practical test is made with each lot of semolina to determine the amount of gluten it contains. A kilo of semolina is put into a basin of water and kneaded by hand until the starch and other matters disappear in the washing and the gluten remains in the hand. The loss of gluten by this method amounts to 60 grains in a kilo of semolina. The gluten remaining after the starch is kneaded out is weighed and the batch for the petrin is prepared with reference to the amount of gluten found in the raw material. Here is where skill and experience begin to count. If, for example, an attempt should be made to manufacture a given quantity of macaroni from a certain amount of high-grade semolina and the same quantity from the same amount of fine flour produced by grinding the same wheat, the macaroni produced from the semolina would be very unlike and very superior to that produced from the flour. The flour having been crushed into powder is so separated that what the macaroni manufacturer calls its "force" is completely lost, and the macaroni is brittle and dull of appearance. On the other hand, the macaroni made from the semolina would be translucent and elastic, and, after having been cooked, the lengths of the macaroni still retain their form. These

are the qualities sought by the manufacturer of macaroni: A bright, clear appearance, elasticity before cooking, and sufficient "force" to retain the original form after having been cooked.

MIXING THE SEMOLINA.

There is more gluten in the Russian wheat than in the Algerian, and the semolina manufactured into macaroni without an admixture would not only be dark and dull, but would be very hard upon the machinery of the factory. Algerian semolina, on the other hand, if manufactured into macaroni, would be too brittle to satisfy the requirements of the trade. A mixture must therefore be made in which there will be from 45 to 50 per cent of moist gluten.

The important matter of mixing the different kinds of semolina together having been attended to, the water is next introduced into the steel pan, the quantity varying from 20 to 27 kilograms per 100 kilograms of semolina, depending somewhat upon the nature of the edible paste to be manufactured and the humidity of the semolina itself. This proportion is determined by the experienced judgment of the manufacturer. Very slight differences in the amount of water are necessary for the production of various kinds of pastes, the vermicelli requiring a shade less than any of the others. The mixture of semolina and water properly kneaded supplies the true macaroni, but with the increase in competition and changes in public taste, a demand has arisen for an edible paste in which eggs are kneaded, and manufacturers also introduce rice flour, corn flour, and potato flour. To satisfy an entirely local clientele, garlic is occasionally introduced. The same is true of edible pastes into which the juice of carrots, turnips, cauliflower, and cabbage is mixed. These varieties of the article are quite unknown in the United States. The rice, corn, and potato flours are only employed to affect the color of the finished product and the cost of the same. These adulterations are only used in the case of the cheaper macaronis.

The paste of the highest grade is translucent and of the shade of very light amber. Pure white macaroni may seem more attractive, but its color is often due to the admixture of rice flour. The cheaper hard wheats always produce a dark semolina, and their color must be toned up in order to make them marketable. In the case of macaroni of the first quality the whitening is brought about by the kneading process, which is continued from thirty-five minutes to fifty minutes. Ordinary paste is kneaded thirty-five minutes, and the extension to fifty minutes is only in exceptional cases and for the production of a superfine article. The difference between an ordinary white macaroni and that of an equally white cheaper macaroni can be distinguished by holding lengths of them up to the light. The rice-flour macaroni will be found to be dull white like a sheet of paper, while the thoroughly kneaded and better quality of macaroni will be translucent.

CURING OPERATIONS.

After the kneading of the paste and its manufacture into forms, the skill of the expert is again called into play while the curing process takes place.

In discussing the matter with me, Mr. François Scaramelli said:

This is the most delicate feature of the business. I believe that it takes about twenty years to get a factory into thorough running order. For fifteen years I myself have given instructions to one of my most competent men on the subject of drying, in order to give to myself more personal leisure. Yet to-day if that man is left entirely alone, difficulty is likely to occur. To know exactly when the macaroni is "ripe," so to speak, and ready for the market, amounts to an intuition. It is absolutely impossible to establish cut-and-dried methods. Personal experience must be the only guide. It is right at this point, in my opinion, that the first efforts to manufacture macaroni in the United States have not succeeded. The promoters have not had sufficient patience in going about their work. They have expected to accomplish in a few years that for which we have required a lifetime of labor. I have seen some American macaroni, and my main criticism on it is that it is not solid, though in every other respect it leaves something to be desired. If a macaroni is permitted to "take cold," as I may express it, during the drying process, in spite of its condition as respects the quantity of gluten and the duration of the kneading process, it lacks the elasticity which a perfect macaroni should have. When the product is properly cured, one should be able to take a section a meter long, and, holding it up by the end, it should bend readily, like a whip, without breaking. The same macaroni improperly cured will break; it will break before cooking and it will be still more brittle after having been cooked. This elastic quality causes the macaroni after cooking to retain its original form, desired by all lovers of the food, while the inferior article melts together and becomes more like paste.

In all of the large factories the macaroni is dried in rooms in which the temperature is kept at about 70° F., except in summer, when the weather alone regulates this matter. Vermicelli and macaroni are hung on racks, and the edible pastes molded into forms are placed in drawers. This is the so-called "French system," and any variation in the temperature causes the macaroni to warp. The small manufacturers have great difficulty in curing their product, and it must be consumed within a week or so, or the deterioration in the quality is so rapid that customers protest. More carefully prepared macaroni, especially if it is packed in tight boxes, retains its excellence from six months to a year in ordinary climates, although every "gourmet" who cares much for this food insists that the sooner it is eaten after coming from the factory the better. I am satisfied that there is some truth in this claim, as I have frequently observed very marked difference in the quality of macaroni served upon my own table, when bought at the same shop and at the same price. This deterioration is what most strongly confirms my opinion that edible pastes will not become a staple article of diet in the United States until we have domestic manufactories so organized that the consumer may be always assured of fresh merchandise.

While the drying process in rooms seems to be best adapted to the manufacture of macaroni on a large scale, it is still claimed that the merchandise cured in the open air is better than that cured by artificial heat. Mr. Scaramelli attributes the success of a number of Neapolitan manufacturers who secure their semolina from Marseille to the fact of their adherence to this old-fashioned method. Many travelers can recall having seen in Naples, upon the roofs of dwellings, wooden frames with the family supply of macaroni drying thereon. Mr. Scaramelli himself has recently adopted this system (Plate IV, fig. 2) for a part of his output, and is well satisfied with his success. The process requires the closest supervision, as, after the merchandise becomes once dry, it is taken to a "chamber of repose," a ventilated but closed room, and after remaining there several hours is again hung in the open air for five or more hours, and then a second time is sent to the chamber of repose, after which it is taken to the packing room and placed on sale.

This frequent switching about of the macaroni from the open air to the chamber of repose and back again is caused by the fact that when first exposed to the open air the product begins to dry from the outside, and if permitted to remain too long would warp. To prevent this it is taken to the dark room before completely cured, where it straightens itself, the moisture from the center spreading throughout the thickness of the paste. When it is judged that the same degree of humidity exists in every portion of the macaroni it again goes into the open air, so that the remaining moisture may be expelled. Very much the same care is given to this drying process as to the seasoning of lumber, the object being to assure thoroughness and to prevent warping.

The open-air curing process is not applicable, of course, to the drying of the "petits pâtes" (the small forms—stars, circles, etc.) (Plate V), and Mr. Scaramelli has within a few months devised a system for treating them in large revolving cylinders of metallic netting in a room heated by steam. When his apparatus is fully completed these "petits pâtes" will be carried by pneumatic power in tubes from the pressing room to the drying chamber, where they will drop in a continual stream into the continually revolving cylinders. Each cylinder is capable of drying 120 kilograms every two hours. From the cylinder the "petits pâtes" descend by gravity to a mechanical sifter, after which they are placed in boxes.

Most of the mechanical operations in the factories are carried on by men; the majority of the labor is undertaken by women and girls. Men are paid from 3.50 to 4.50 francs (67 to 86 cents) per day; women from 1 to 2.25 francs (19 to 43 cents), and boys from 1 to 1.65 francs (19 to 31 cents) per day.

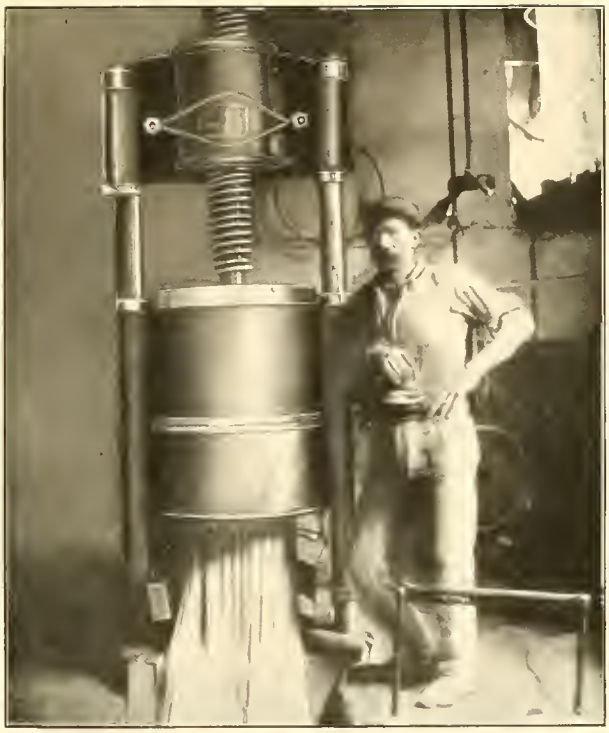


FIG. 1.—VERMICELLI PRESS AT THE FACTORY OF F. SCARAMELLI FILS.

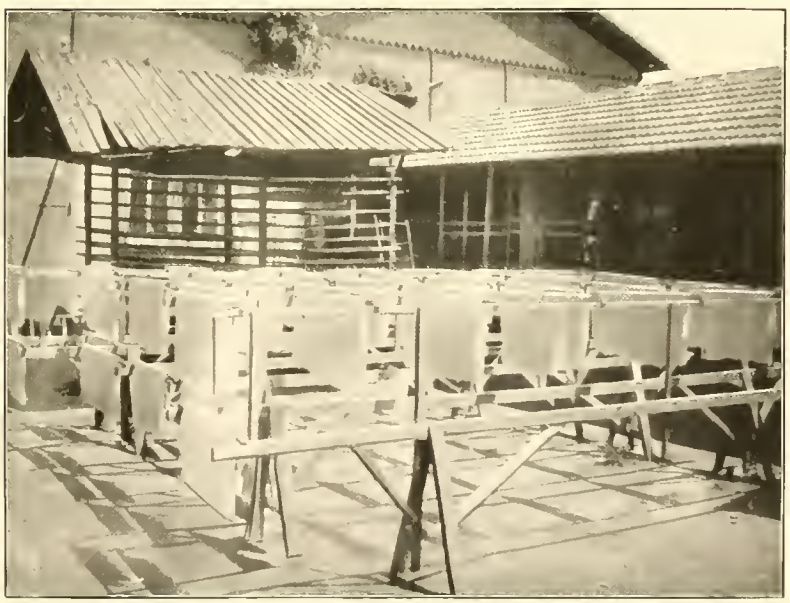
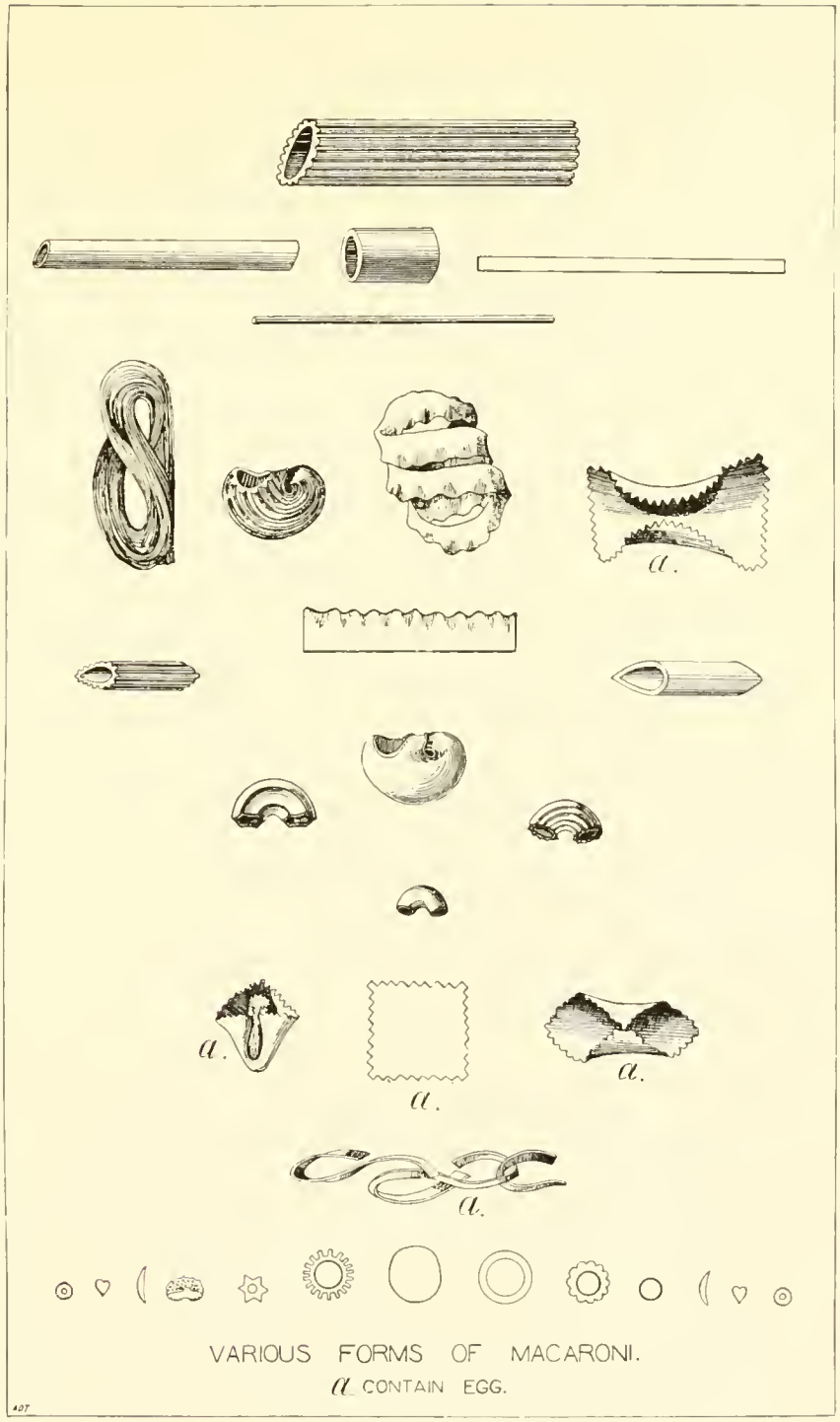


FIG. 2.—SECTION OF OPEN-AIR CURING DEPARTMENT AT THE FACTORY OF F. SCARAMELLI FILS.



VARIOUS FORMS OF MACARONI.

a CONTAIN EGG.

The most careful economy is observed, all ends and broken pieces of paste being saved, and after the accumulation of a considerable quantity the whole is boiled for two or three minutes, then mixed with fresh macaroni, and worked up into macaroni of secondary quality.

DURUM WHEAT FOR BREAD FLOUR.

Before leaving Mr. Scaramelli's factory I was supplied by him with the following interesting information on the subject of flour: The best type of Provençal wheat, which is of the soft variety, and known as "Tuzelle," is very highly valued, and produces a very white flour. Another flour commonly manufactured in Marseille is known as the "Berdiansk." This is the product of the Russian wheat of the same name, and the flour is strong in gluten, and darker than the Tuzelle. The two are mixed in the city, generally in the proportion of 20 kilograms of Russian and 40 kilograms of Provençal. The mixture produces a standard type of bread in this city, and both of these flours are required throughout southern France, and are known as far north as Lyon. In Paris bread is manufactured wholly from local flour, and in order to secure the required amount of proteids bakers mix with their flour from 2 to 4 per cent of bean flour. However, even with this addition, the Parisian bread contains less gluten than that of Marseille.

TABLES OF EXPORTS, IMPORTS, AND PRICES.

Exports of semolina from Marseille, by countries.

Country.	1897.	1898.	1899.	1900.
	Kilos.	*Kilos.*	*Kilos.*	*Kilos.*
Russia	2,035,385	1,162,467	1,559,004	2,455,027
Sweden	756,601	675,089	934,590	1,115,884
Norway	492	.....	985	7,929
Denmark	247,980	132,757	126,434	84,629
England	823,998	702,086	514,906	678,630
Germany	2,672,620	2,108,157	2,734,343	1,993,307
Holland	326,599	430,393	933,992	418,983
Belgium	200,300	261,489	272,676	279,453
Switzerland	10,495,385	8,709,651	9,308,214	10,671,287
Spain	773,841	168,845	143,002	347,417
Austria	637,220	467,220	482,836	367,675
Italy	1,715,822	899,773	2,146,192	1,595,505
Turkey	741,860	379,835	1,643,181	406,045
Greece	.....	.....	.....	12,919
Malta	1,473,777	540,645	298,578	102,472
Egypt	2,580,577	1,250,657	940,803	1,135,301
Tripoli	1,070,100	321,943	184,160	774,536
Morocco	3,399,463	1,340,923	126,940	175,026
Algeria	5,012,324	5,352,750	2,465,432	2,125,969
Tunis	29,892,241	14,637,230	11,927,622	11,715,560
Neutral zone	.....	.....	491,941	509,444
Other countries and ships' provisions	748,488	930,307	23,988	28,486
Total	64,603,073	40,472,217	37,259,819	37,001,484

Exports of edible pastes from Marseilles, by countries, 1899 and 1900.

Country.	1899.	1900.
	Kilos.	*Kilos.*
Russia	145	545
Sweden	11,520	19,503
Norway	6,982	31,679
Denmark	14,105	27,000
England	406,364	406,611
Germany	277,765	255,384
Holland	67,085	55,467
Belgium	377,886	333,145
Switzerland	64,615	43,940
Portugal	2,555	2,009
Spain	26,908	50,872
Austria	97,826	58,570
Italy	456,135	123,227
Roumania	17,267	8,705
Greece	.....	7,309
Bulgaria	36,340	3,222
Turkey	192,641	183,559
Malta	103,586	120,906
Egypt	196,044	79,020
Tripoli	12,661	5,300
Morocco	13,491	7,495
Africa	.....	7,850
Mauritius	39,980	55,794
India	18,105	32,055
Dutch Indies	13,194	.....
China	7,241	8,035
Japan	4,162	*5,330
Australia	9,087	9,584
United States of America	761,956	712,107
Mexico	97,400	83,291
Guatemala	13,473	.....
New Granada	75,640	75,437
Brazil	16,215	6,218
Argentine Republic	16,848	15,084
Uruguay	.....	233
Canada	10,720	11,876
British America, other	9,220	.....
Haiti	12,968	10,215
Persia	.....	51,049
Central America	.....	5,880
Chile	.....	661
Algeria	342,419	327,088
Tunis	148,980	95,464
Senegal	28,816	29,854
Guinea	4,830	10,628
Nossi Be	.....	7,385
Madagascar	68,476	132,965
Reunion	3,062	22,521
French India	11,726	4,147
Indo-China	22,988	109,248
New Caledonia	56,281	62,640
French Guiana	28,208	46,980
Martinique	84,139	54,893
Guadeloupe	57,475	35,482
Other countries	80,348	.....
Navy and zone	408,351	562,540
Provision to ships	225,746	249,881
Total	4,137,468	3,924,258

* Including Siam.

Exportations of wheat at Marseilles, by countries.

		Quintals.
1900.	Russia	3,815,988
	Turkey in Europe, and Danube principalities	199,513
	Turkey in Asia	51,288
	Australia	27,875
	United States	105,135
	Argentina	275,125
	Algeria	768,682
	Tunis	413,355

	Quintals.
1900. Naples	89
French ports	8,839
Total	5,676,189
1899	7,255,985
1898	9,886,243
1897	6,808,727
1896	7,735,008

Range of prices of semolina per 100 kilos at Marseille during the years 1885 to 1900.[a]

Year.	Highest.	Lowest.
	Francs.	*Francs.*
1885	32.00	27.00
1886	31.50	28.00
1887	31.50	26.00
1888	26.50	24.50
1889	25.50	24.00
1890	27.00	23.50
1891	31.00	24.00
1892	30.50	23.50
1893	27.00	22.00
1894	22.00	14.00
1895	16.50	16.00
1896	23.00	14.50
1897	28.50	18.00
1898	43.00	26.50
1899	27.00	22.00
1900	27.50	23.50

[a] Supplied by G. P. Bottazzo.

Values of declared exports of macaroni and vermicelli to the United States for the year 1900.

Country.	For quarter ended— March 31.	June 30.	September 30.	December 31.	For the year.
France:					
Bordeaux	$4,346.55	$831.92	$25,012.66	$10,324.29	$40,518.42
Dijon	1,314.81	.....	2,376.31	2,228.54	5,919.66
Lyon	17,096.00	.....	10,326.45	21,203.75	48,626.20
Marseille	6,921.36	7,965.11	9,679.91	18,903.57	43,469.95
Other cities	270.90	297.76	.....	593.48	1,162.14
Total	29,949.62	9,097.79	47,395.33	53,253.63	139,696.37
Italy:					
Castellamare di Stabia	118,046.69	130,183.39	103,041.63	149,742.25	501,013.96
Genoa	6,491.45	10,618.27	6,856.48	13,543.77	37,509.97
Leghorn	877.60	.....	892.40	2,822.16	4,592.16
Naples	2,518.36	1,344.77	576.99	1,788.36	6,228.48
Palermo	19,643.00	6,735.00	4,518.00	24,004.00	54,900.00
Other cities	452.30	184.54	125.16	1,041.10	1,803.10
Total	148,029.40	149,065.97	116,010.66	192,941.64	606,047.67
Spain:					
Corunna (to Porto Rico)	.....	1,163.60	.....	.....	1,163.60
Austria:					
Trieste	.....	.....	.....	602.65	602.65
Grand total	.....	.....	.....	.....	747,510.29

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